266

SERVICE MANUAL

AKAI AMPLIFIER

MODEL AA-6600

266

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I. SPECIFICATIONS

SPECIFICATIONS

TUNER SECTION

FREQUENCY RANGE
: FM : 88 to 108 MHz
AM : 530 to 1605 kHz

SENSITIVITY : FM : 2.0 μV (98 MHz, 100% Mod.
: 3% Dis. at 300 Ω)
AM : 20 μV (1000 kHz, 30% Mod.
10% Dis. with external antenna)

S/N RATIO : FM : Better than 60 dB
AM : Better than 40 dB

HARMONIC DISTORTION
: FM : Less than 0.8% (400 Hz, 100% Mod.)
AM : Less than 3.0%

IMAGE FREQUENCY REJECTION
: FM : Better than 60 dB (98 MHz)
AM : Better than 50 dB (1000 kHz)

FM MULTI-SEPARATION
: Better than 30 dB (400 Hz)

ANTENNA : FM : 300 Ω, 75 Ω (with external antenna)
AM : Ferrite Bar Antenna
(with external antenna terminals)

POWER AMPLIFIER SECTION

POWER OUTPUT : Music Power : 120 W (60 W/60 W) at 4 Ω
100 W (50 W/50 W) at 8 Ω
Roted Power : 75 W (37.5 W/37.5 W) at 8 Ω

FREQUENCY RESPONSE
: PHONO : RIAA (±1.5 dB)
TAPE, AUX : 20 to 50,000 Hz –3dB

S/N RATIO : PHONO : Better than 65 dB
TAPE, AUX : Better than 70 dB

HARMONIC DISTORTION
: Less than 0.3% (45 W/8 Ω 1kHz)

INTER MODULATION
: 0.3% (45 W/8 Ω)

INPUT SENSITIVITY
: PHONO : 3.0 mV with 50 kΩ
TAPE, AUX : 200 mV with 100 kΩ

OUTPUT TERMINALS
: REC. Out : 200 mV
DIN. Out : 30 mV
SPEAKER OUT : (A, B)

TONE CONTROL : BASS : 50 Hz ±10 dB
TREBLE : 10 kHz ±10 dB

LOUDNESS CONTROL
: 100 Hz + 6 dB
10 kHz + 6 dB

LOW FILTER : –8 db at 50 Hz
HIGH FILTER : –8 dB at 10 kHz

OUTPUT IMPEDANCE
: 4 to 16 Ω

POWER SUPPLY

POWER SOURCE
: 100 V/110 V/120 V/200 V/220 V/
240 V, 50/60 Hz.

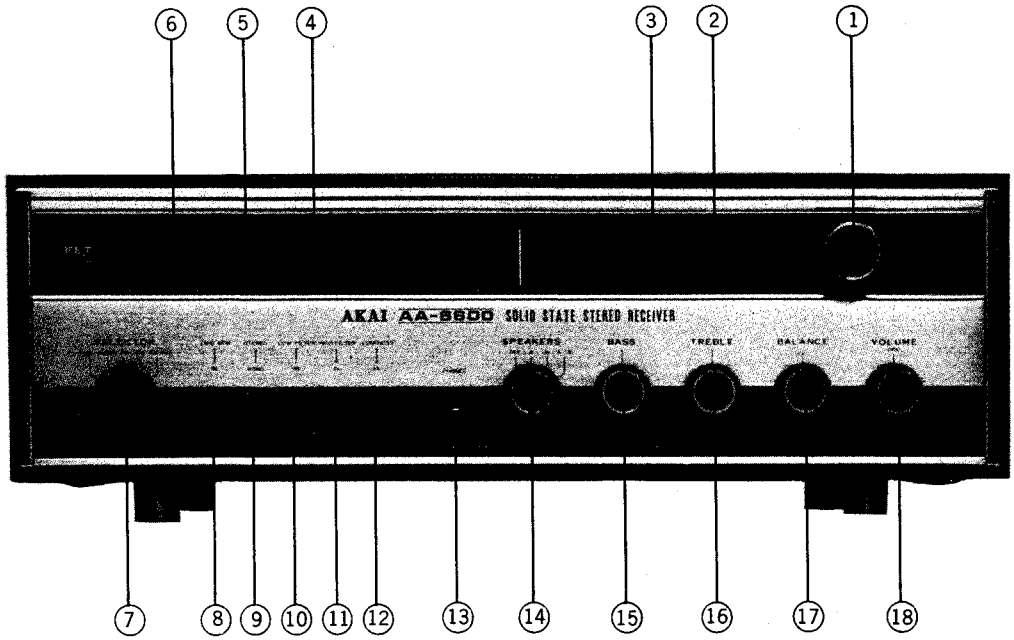
POWER CONSUMPTION
: 30 W no signal
200 W maximum

DIMENSIONS

DIMENSIONS : 5-1/4" x 17-1/2" x 13-3/8"
(33 x 445 x 340 mm)

WEIGHT : 24.4 lbs (11.1 kg)

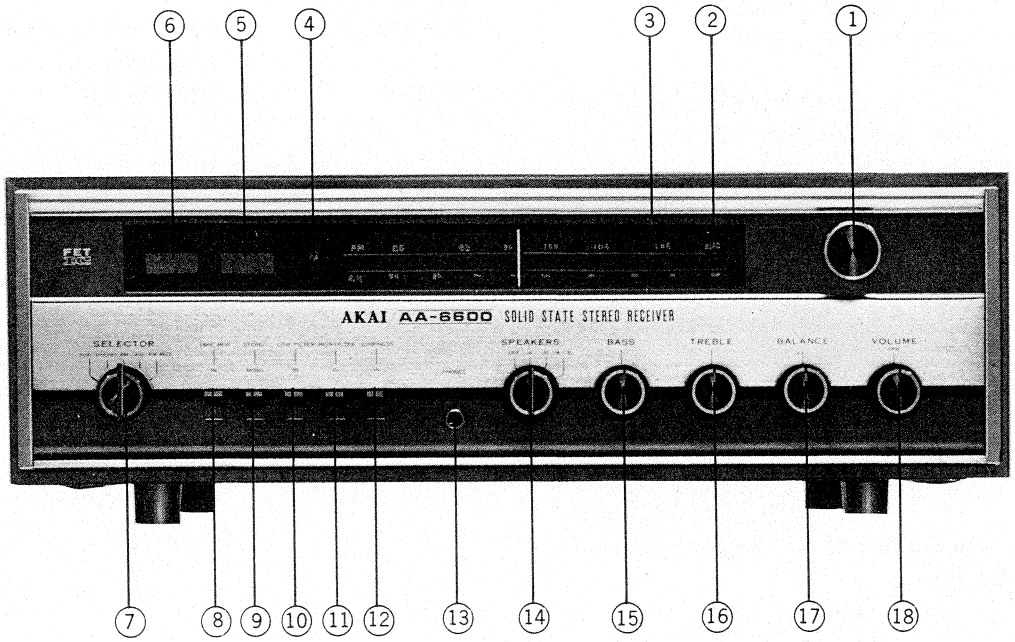
II. CONTROLS AND CONNECTIONS



CONTROLS

① TUNING KNOB : For station selection
② FM DIAL SCALE : Indicates FM broadcast band. Calibrated in MHz (mega hertz)
③ AM DIAL SCALE : Indicates AM broadcast band. Calibrated in KHz (kilo hertz)
④ STEREO INDICATIOR : Pilot lamp indicates reception of stereo FM broadcast.
⑤ FM CENITER TUNING METER : Indicates FM proper tuning. Meter needle in center indicates perfect tuning.
⑥ FM/AM SIGNAL STRENGTH METER : For FM/AM signal strength indication. Meter needle at right limit indicates perfect tuning.
⑦ SELECTOR SWITCH : Select the input.
AUX : For tape recorder and external tuner
PHONO : For turntable
AM : For AM radio reception
FM : For FM radio reception
FM MUT : For elimination of FM tuning distortion on FM radio reception
⑧ TAPE MONITOR SWITCH : Permits recording with a three-head tape recorder when in "IN" position. Also used for playback.
⑨ MODE SWITCH : Select stereo or monaural.
⑩ LOW FILTER : For eliminating very low frequency noises, such as those produced by phono turntable or tape deck.
⑪ HIGH FILTER : For eliminating annoying noises produced by record scratch, radio static, whistle and other interference.
⑫ LOUDNESS CONTROL : Compensates for insufficient sound volume of bass and treble, during low-volume operation.
⑬ PHONES JACK : For stereo headphones.
⑭ SPEAKER SYSTEMS SELECTOR : For selection of speaker systems "A", "B" or "A+B". In OFF position speakers are off and only headphones output remains.
⑮ BASS CONTROL : Bass response control for loudspeakers. Designed to get the most naturalized bass reproduction when this knob is at flat position. By turning clockwise, the bass response can be increased.
⑯ TREBLE CONTROL : Treble response control for loudspeakeres. By turning this knob clockwise the treble response can be increased.
⑰ BALANCE CONTROL : For balancing volume of left and right speakers. When it is turned clockwise, the volume of the left channel is decreased. When it is turned counterclockwise, the volume of the right channel is decreased.
⑱ VOLUME CONTROL & POWER SWITCH : For volume adjustment. In OFF position, power is cut off.

II. CONTROLS AND CONNECTIONS



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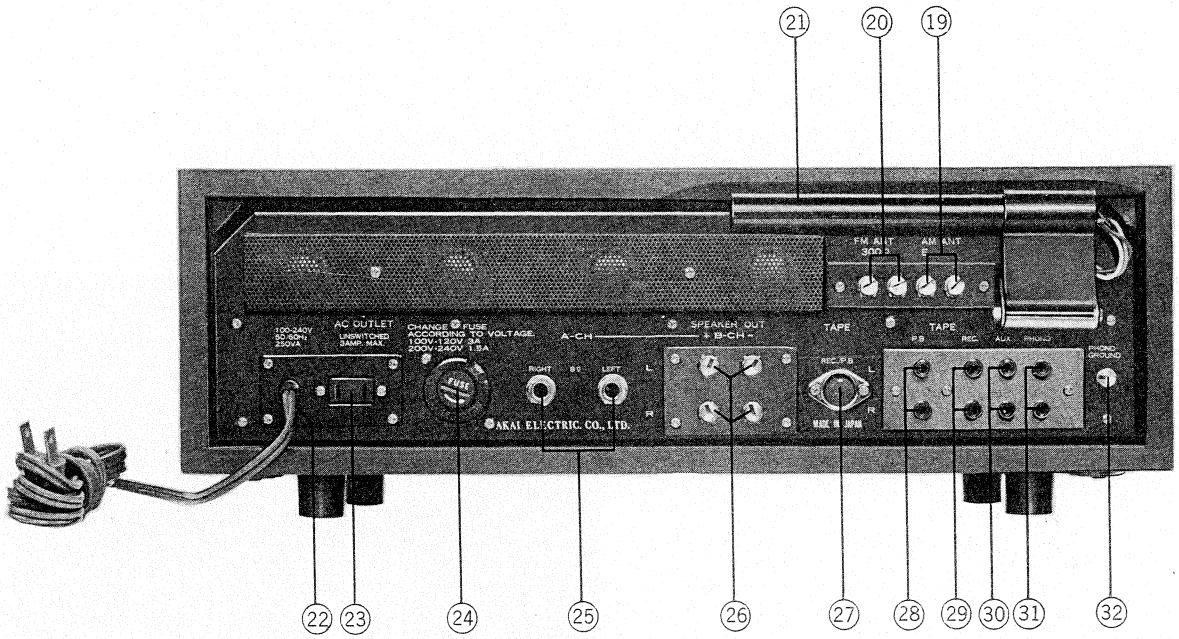


CONTROLS

⑲ AM ANT. TERMINAL : Used for external antenna connection if the radio wave not strong enough to be picked up by BAR ANTENNA.

⑳ FM ANT. TERMINAL : Used for external 300 Ω feeder antenna connection.

㉑ AM BAR ANTENNA : A hinged ferrite antenna for reception of AM broadcast. For best results extend this antenna.

㉒ AC CORD : 100 V ~ 240 V 50/60 Hz. Connect this cord to AC power source after checking power voltage.

㉓ AC OUTLET : A power supply for record player or tape recorder. This power supply provides up to 300 watts. Note that this power is not interlocked with POWER SWITCH.

㉔ VOLTAGE SELECTOR & FUSE : Permits power voltage change ranging from AC 100 to 240 volts. Fuse must be as follows :

100 - 120 V ..... 3 A
200 - 240 V ..... 1.5 A

㉕ SPEAKER OUTPUT JACK : For connection of 2 P plug permitting speaker system 'A' operation. Use a speaker with the impedance preferably of more than 4 Ω (usually 8 Ω).

㉖ SPEAKER OUTPUT TERMINAL ; Supplies out-put to Speaker System 'B'. Connect plus and minus terminals to correspond with polarity of the speaker. Use a speaker with the impedance preferably of more than 4 Ω (usually 8 Ω).

㉗ DIN JACK : This connection is used instead of TAPE REC.JACK and TAPE P.B. JACK if the tape recorder has corresponding connections.

㉘ TAPE P.B. JACK : Connects to the output terminal of a three-head tape recorder, and thereby permits monitoring the progress of performance by using MONITOR SWITCH.

㉙ TAPE-REC. JACK : Connects to the input terminal of a tape recorder. The recording source may be selected by SELECTOR SWITCH.

㉚ AUX JACK : Used for relatively high voltage input, such as radio tuner, output from the amplifier of a tape recorder or record player with ceramic or crystal cartridge. (200 mV)

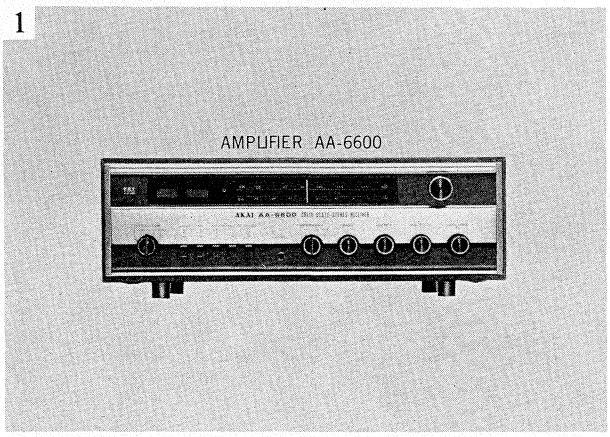
㉛ PHONO JACK : Used with a low input cartridge (2 to 5 mV). This jack must be shorted by a shorting pin when not in use, to avoid hum.

㉜ PHONO GROUND TERMINAL : Used to ground phono motor and arm of record player. If this connection causes noise, do not use.

III. HOW TO DISASSEMBLE

In case of trouble, etc. necessitating disassembly, please disassemble in the order shown in photographs. Remantle in reverse order.

1



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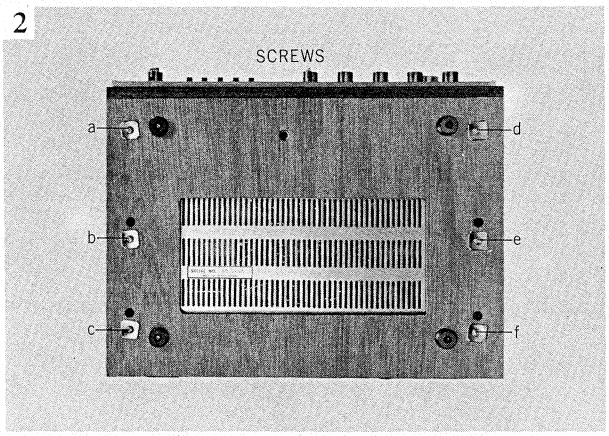

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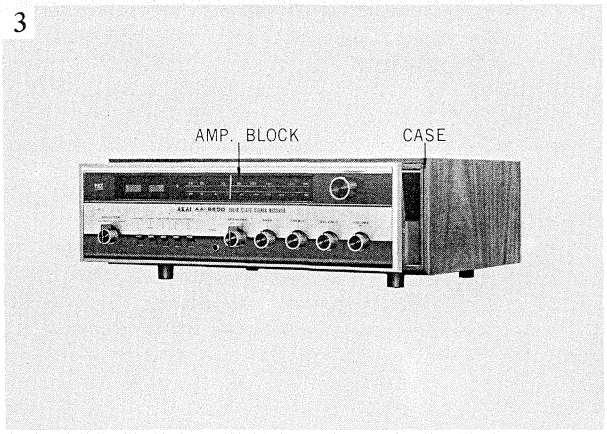

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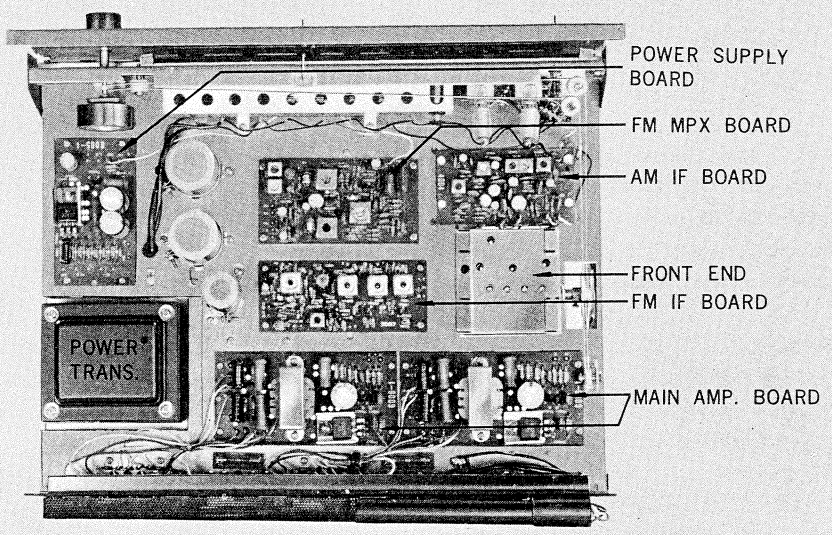
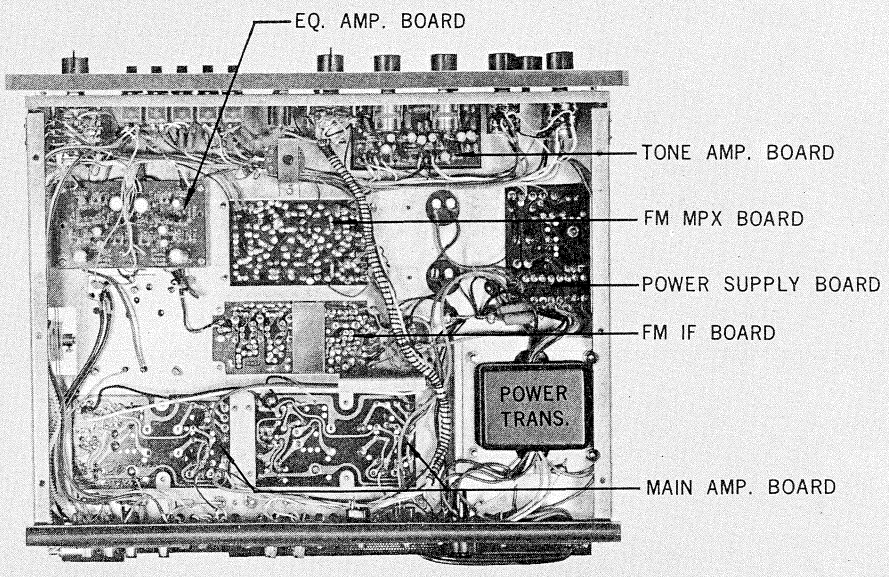

POWER SUPPLY BOARD
FM MPX BOARD
AM IF BOARD
FRONT END
FM IF BOARD
POWER TRANS.
MAIN AMP. BOARD

5


EQ. AMP. BOARD
TONE AMP. BOARD
FM MPX BOARD
POWER SUPPLY BOARD
FM IF BOARD
POWER TRANS.
MAIN AMP. BOARD

IV. TUNER SECTION ADJUSTMENTS

1. FM IF Circuit (2007 FM IF BOARD)

FM IF Circuit adjustment should be made with calibrated instruments because this adjustment has a great influence on tone quality, separation, S/N, etc. in stereo FM reception.

1) Instruments Required :
   Sweep Generator
   Oscilloscope
2) Instrument Connections :

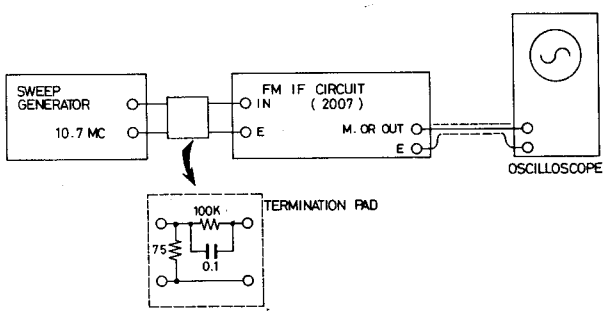


Fig. 1

(a) Connect the output lead of the Sweep Generator to test point (IN) and (E) on IF printed board (2007).
(b) Connect the input lead of the Oscilloscope to test point (M) and (E).
(c) Set Frequency Band of the Sweep Generator to 10.7 MHz.
(d) Adjust V-POSITION, SWEEP-WIDTH, and CENTER FREQUENCY so that the waveforms are in the center of the Oscilloscope.
(e) Set STEREO MODE SWITCH on the front panel of AA-6600 to "MONO" position and SELECTOR SWITCH to "FM" position.
(f) TUNING DIAL should be set to a non-receiving point on the dial.

3) IF Transformers (10.7 MHz) Adjustments

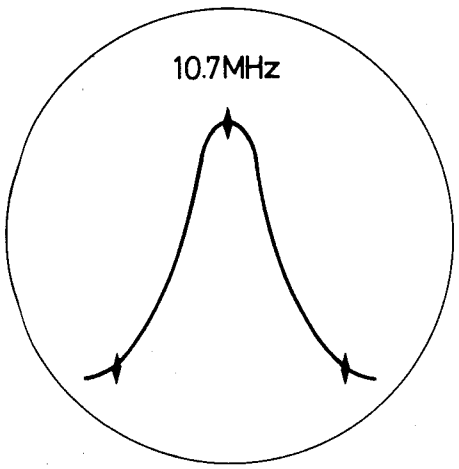


Fig. 2

(a) For adjustment of cores of FM-IF transformers, adjust with 40 dB (100 μV) output level of the Sweep Generator.
(b) Adjust the upper and lower cores of T-201, T-202, T-203, T205 and bottom core of T-204 to obtain the waveform as shown in Fig. 2. Adjust to as maximum an amplitude as possible.
(c) Then change the output lead of the Sweep Generator to FM Antenna Terminal ; also the input of the Ocilloscope to test point (out) and (E) on the IF Board (2007). Adjust the core of L-104 (Front end), T-201 (upper and lower) and the upper core of T-204 to obtain the waveform shown in Fig. 3. Adjust to maximum amplitude and proper linearity between ± 150 KHz markers.

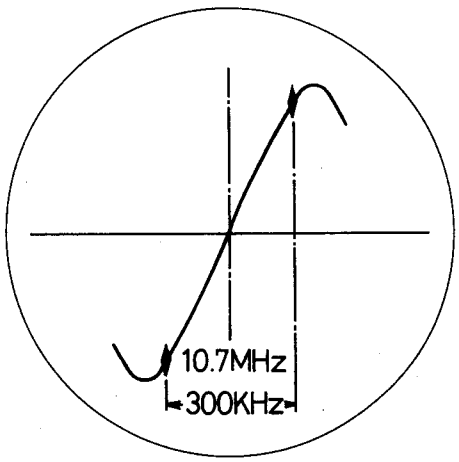


Fig. 3

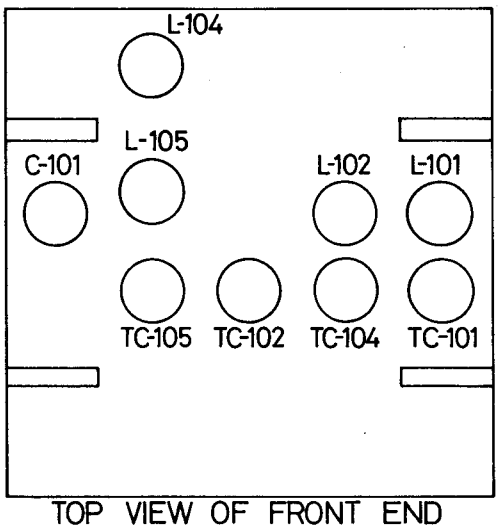


Fig. 4

2. Adjustment of FM Reception Frequency Range

1) Instruments Required :
   FM Signal Generator
   Distortion Meter
2) Instrument Connections

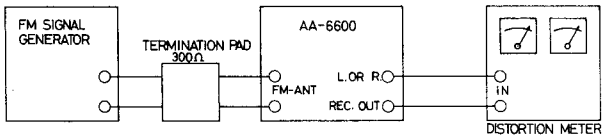


Fig. 5

(a) Connect the Signal Generator (MSG-276A) output lead to the FM antenna terminals of Model AA-6600 through the 300 Ω termination pad.
(b) Set SELECTOR SWITCH to "FM" position, STEREO MODE SWITCH to "MONO," and set the SPEAKER SELECTOR SWITCH to "OFF" position.
(c) Connect the Distortion Meter to "TAPE-REC" terminal on rear panel (See Fig. 4).

3) Adjustments
(a) Set the Signal Generator frequency to 87.7 MHz (internal modulation 400 Hz, 100%), and the output to 60 db (1 mV).
(b) Set the Tuning Dial to the left end of the dial.
Adjust L-105 of the front end (see Fig. 4) so that the Distortion Meter Level indicates maximum.
(c) Set the Signal Generator frequency to 108.3 MHz. Set the Tuning dial to the right end of the dial.
Adjust TC-103 (see Fig. 4) on the front end so that the Distortion Meter Level indicates maximum.
(d) Repeat steps (b) and (c) until no further improvement is possible.

3. FM TUNER TRACKING ADJUSTMENT

1) Instrument Connections
Use the same instruments as used in item 1-2 (Fig. 5) and connect them in the same way.
2) Adjustments
(a) Set the signal generator frequency to 90.0 MHz (internal modulation 400 Hz 100%), and the output to 60 dB (1 mV).
(b) Turn the tuning dial to receive the 90.0 MHz signal. Then decrease the output of the Signal Generator so that the distortion factor on the meter is approximately 3%.
(c) Adjust the cores of L-101 and L-102 on the front end of Model AA-6600 (see Fig. 4) so that the Distortion Meter Level indicates maximum and the distortion factor is minimum.
(d) Set the Signal Generator frequency to 105 MHz, then turn the Tuning Dial to receive this signal. Adjust the trimmer condensers TC-101 and TC-102 of the tuning variable condenser in the front end so that the Distortion Meter Level indicates maximum and the distortion factor is minimum.
(e) Repeat steps (c) and (d) until no further improvement is possible.

4. TUNING INDICATOR CHECK AND MUTING ADJUSTMENT

1) Use the same instruments as used in item 1-2 and connect them in the same way (See Fig. 5). Set the Signal Generator frequency to 98 MHz, and the output to 60 dB (1 mV). Turn the tuning dial to receive this signal and make sure that the tuning indicator deflects more than 5 mm to both sides from beginning to end of signal reception.
2) Then decrease the attenuater of the Signal Generator to 20 dB and change the SELECTOR SWITCH to "FM-MUT" position. Adjust VR-201 (100KΩ-VR) of the FM IF BOARD (2007) until the distortion meter level indicates the critical point of "Zero".

5. S.C.A. FILTER AND 19KC FILTER ADJUSTMENT

1) Instruments Required :
   Audio Oscillator
   High Sensitive AC Voltmeter
   Connections :

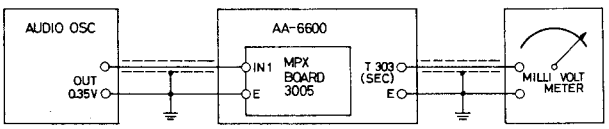


Fig. 6

(a) Connect the audio oscillator output to terminals (IN 1) and (E) of MPX printed board (3005) and a milli-voltmeter to T-303 center point (second Y) and (E).
(b) Set the audio oscillator frequency to 67 kHz, and the output to 1.0 V.
Adjust the core of L-301 so that the milli-voltmeter indicates minimum.
(c) Change the audio oscillator frequency to 19 kHz and adjust the core of L-302 so that the milli-voltmeter indicates minimum.

6. MPX CIRCUIT AND PILOT LAMP SENSITIVITY ADJUSTMENT

1) Instrument Connections :

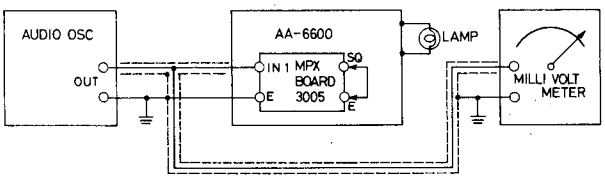


Fig. 7

(a) While this adjustment is being made, SQ terminal should be grounded. Connect the audio oscillator and the milli-voltmeter to terminals (IN 1) and (E) of MPX Printed Board (3005).

(b) Watch the red lamp (12 V, 20 mA) on the front panel (to the right of Tuning Indicator).

(c) Set the audio oscillator frequency to 19 kHz and increase the oscillator output until the lamp lights.

(d) By adjusting the core of T-301 and T-302, decrease the oscillator output so that the lamp lights at minimum output.

(e) When the adjustments outlined above are completed, the light begins to light at approximately 16 to 12 mV of the oscillator output.

(f) The lamp should be lit be low 15 mV.

7. SEPARATION ADJUSTMENT

1) Instruments Required :
FM Signal Generator
Stereo Modulator
AC Voltmeter (VTVM)

2) Instrument Connections :

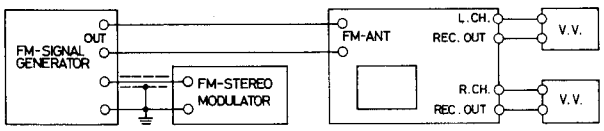


Fig. 8

(a) Adjust PILOT SIGNAL 19 kHz of the FM stereo modulator to 10% modulation and adjust MAIN SIGNAL (L + R) of the FM stereo modulator to 400 Hz, 90%. Then connect output to EXT.MOD terminals of the FM Signal Generator.

(b) Set the FM Signal Generator to EXT.MOD and its modulation to 100%.

(c) Set the FM Signal Generator frequency to 98 mHz and the output voltage to 60 dB (1 mV). Connect output to the FM-ANT terminals of Model AA-6600.

(d) Connect a milli-voltmeter (VTVM) to the "TAPE-REC" terminals (both channels).

(e) Receive signal from FM Generator by tuning the AA-6600.

(f) Turn MPX-SEPARATION variable resistor VR-551 (located at bottom of chassis near phone jack assembly) fully clockwise.

(g) Set the FM Stereo Modulator Signal to "MAIN" (L + R), and check whether the outputs of both channels are balanced. If they are out of balance, adjust by turning BALANCE KNOB on the front panel.

(h) Set the FM Stereo Modulator Signal to "L" and adjust T-302 and T-303 so that the milli-voltmeter connected to "R" channel indicates minimum.
Then adjust VR-551 so that "R" channel output becomes minimum.

(i) Set the FM stereo modulator signal to "R" and note the indication of the milli-voltmeter connected to "L" channel. Then re-adjust T-302 and VR-551 so that the leakages of R Channel and L Channel are as closely balanced as possible.

8. AM-IF CIRCUIT ADJUSTMENT

1) Instrument Connections

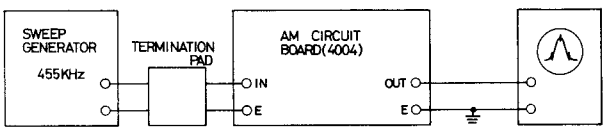


Fig. 9

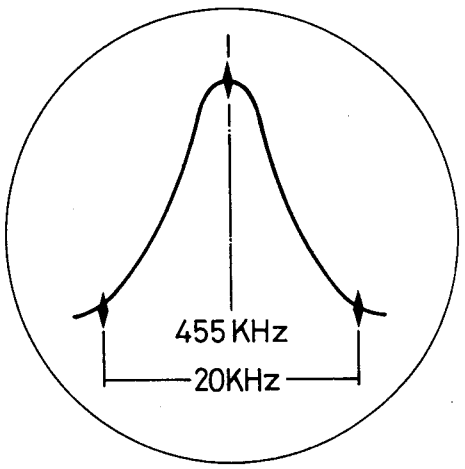


Fig. 10

2) Adjustments

(a) Connect the Sweep Generator output lead to test point (IN) and (E) of the AM-IF circuit board (4004). Connect the oscilloscope input lead to test point (OUT) and (E). (Fig. 9).

(b) Set the Sweep Generator FREQUENCY BAND to 455 kHz. Adjust V-POSITION, SWEEP-WIDTH, AND CENTER FREQUENCY respectively so that the waveform is at the center of the Oscilloscope.

(c) Turn SELECTOR SWITCH on the front panel to "AM" position and VOLUME to minimum position.

(d) Adjust the Sweep Generator output to approximately 50 dB (310 μV). Then adjust the upper and lower cores of T-402 and T-403 so that the waveforms shown in Fig. 10 are obtained. Adjust them so that the center markers divide the waveforms into two symmetrical parts and the highest peak value is obtained.

9. AM RECEIVING FREQUENCY RANGE ADJUSTMENT

1) Instrument Connections

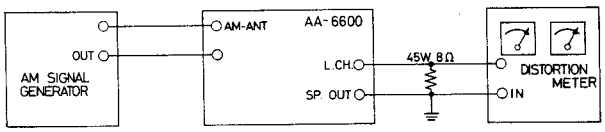


Fig. 11

2) Adjustments

(a) Connect the AM Signal Generator to the AM Antenna terminals. Connect an 8 Ω 45 W dummy load resistor to the left speaker terminal and connect a Distortion Meter to terminal ends. Keep the BALANCE CONTROL KNOB at extreme left (counter-clockwise) position and the VOLUME turned up half-way.

(b) Set the TUNING DIAL to the left end of the dial. Set the AM Signal Generator to 400 Hz, 30% internal modulation ; frequency to 525 kHz ; and output to 100 dB (100 mV).

(c) Adjust the cores of AM local oscillator coil L-401 on AM IF BOARD (4004) so that the level meter indicates maximum.

(d) Turn the TUNING DIAL to the right end of the dial.
Set the AM Signal Generator frequency to 1,620 kHz and adjust trimmer condenser TC-105 of the AM local oscillator variable condenser of the front end so that the Level Meter indicates maximum.

(e) Repeat procedures (a), (b), (c), and (d) until no further improvement is possible.

10. AM TUNER TRACKING ADJUSTMENTS

1) Instrument Connections
Use the same instruments and connections as 1-9 (Fig. 11).

2) Adjustments

(a) Set the AM Signal Generator frequency to 600 kHz (internal modulation 400 Hz, 30%) and the output to 100 dB (100 mV). Turn the dial of AA-6600 to receive the 600 kHz signal.

(b) Adjust the RF transformer T-401 on the AM IF BOARD (4004) and core of the Ferrite Bar Antenna so that the Level Meter which is connected to the speaker terminals indicates maximum.

(c) Next, set the AM Signal Generator frequency to 1,400 kHz, and turn the TUNING DIAL of AA-6600 to receive the 1400 kHz signal.

(d) Repeat procedures (a), (b), and (c) until no further improvement is possible.

V. TROUBLE SHOOTING CHART

NO SOUND

Symptom	Remarks	
Defective speaker system.	• Speaker cables open or shorted. • Speaker voice coil open	• Check speaker terminals for looseness. • Repair or replace Speaker.
No electrical supply.	• Absence of power supply. • Defective power switch. • Line cord plug has faulty contact or is disconnected • Line fuse blown	• Replace power switch • Replace fuse
Blown fuse upon replacement	• Short in power transformer • Shorted diodes for D-801 ~ D-806 • Shorted electrolytic capacitors C-851 ~ C-853 and C-801 ~ C-803	• Replace transformer • Replace defective diodes. • Replace defective capacitors.
Pilot lamp lights, but no sound from speaker.	• Speaker changeover swith at "PHONE" position. • "TAPE MONITOR" switch at "TAPE PLAY" position.	• Set to "A" or "B" position • Set switch to "SOURCE".
Internal Failure.	• Inoperative B power source circuit. • Inoperative B power source circuit. • Fuses F-101 or F-102 (protecting Power transistors) blown.	• Secondary winding in Power transformer open. • Resistors R-801 or R-803 open. • Shorted power transistors. (TR-604, TR-605)
Sound from one channel only.	• Inproper position of balance control. • Defective audio circuit of the channel.	• Adjust balance control. • Check for defect by measuring voltages at check points, comparing them with normal channel.

LOW SOUND LEVEL

Symptom		Remarks
Low sound on both channels.	• Defective power supply circuit.	• Check wiring and voltage.
Low sound on one channel.	• Defective speaker. • Discharged coupling capacitor.	• Replace speaker • Replace defective capacitor (s).

DISTORTION

Symptom	Remarks	
Distorted sound on both channels.	• Defective power supply circuit.	• Check TR-801, TR-802 and D-801 ~ D-806.
Distorted sound on one channel.	• Defective speaker. • Leaky coupling capacitor (s). • Defective or unbalanced power transistors.	• Replace speaker. • Replace defective capacitor (s). • Adjust or replace.

HUM AND NOISE

Symptom	Remarks	
Excessive hum.	• Discharged capacitor in power supply circuit. • Defective rectifying diodes in power supply circuit. • Defective transistor in power supply filter circuit.	• Check C-851 ~ C-853 and C-801 ~ C-803. • Check D-801 ~ D-806. • Replace TR-801 or TR-802 if shorted.
Excessive noise.	• Defective transistor in pre-amplifier circuit. • Defective volume control variable resistor	• Check TR-501 ~ TR-502, TR-901 ~ TR-902 and TR-601 ~ TR-603. • Check VR-502
Inoperative loudness control.	• Defective loudness circuit	• Check C-552, C-553, R-556 and VR-404.
Inoperative tone control	• At "TREBLE" • At "BASS"	• Check C-906, C-907, R-911 and VR-901. • Check C-908, C-909, R-910 R-911, and VR-902.

FM RECEPTION TROUBLE

Symptom		Remarks
No FM reception	• FM front end, FM-IF or MPX circuit defective	• Check SELECTOR switch. Check voltage of TR-201 ~ TR-203, IC1, TR-301 ~ TR-305. Check D-202, D-203, D-303 ~ D-306.
Sound satisfactory but stereo indicator not lit.	• Defective operation of stereo beacon circuit or defective lamp.	• Check voltage of TR-203, TR-301 ~ TR-305 Check D-204, D-307 and D-301 ~ D-302 Replace lamp if defective;.
Incomplete separation during FM reception	• Defective FM multiplex circuit.	• Defective circuit of TR-301 ~ TR-305 on 3005 FM MPX BOARD. • Adjust VR-551 with measuring equipment or stereo FM wave.
Excessive noise	• Weak broadcasting signal or weak input signal to amplifier.	• Orient or replace antenna with a high gain. • Antenna feeder open or loosely connected.
Intermittent noise	• Due to automobile ignition noise.	• Install FM antenna as far away from street as possible.
Noise increase during FM reception	• Due to peculiar FM receiver noise when signal is very weak.	• Set SELECTOR to "FM-MUTE" position. If sensitivity of FM receiver decreases, check or re-adiust FM-IF circuit.

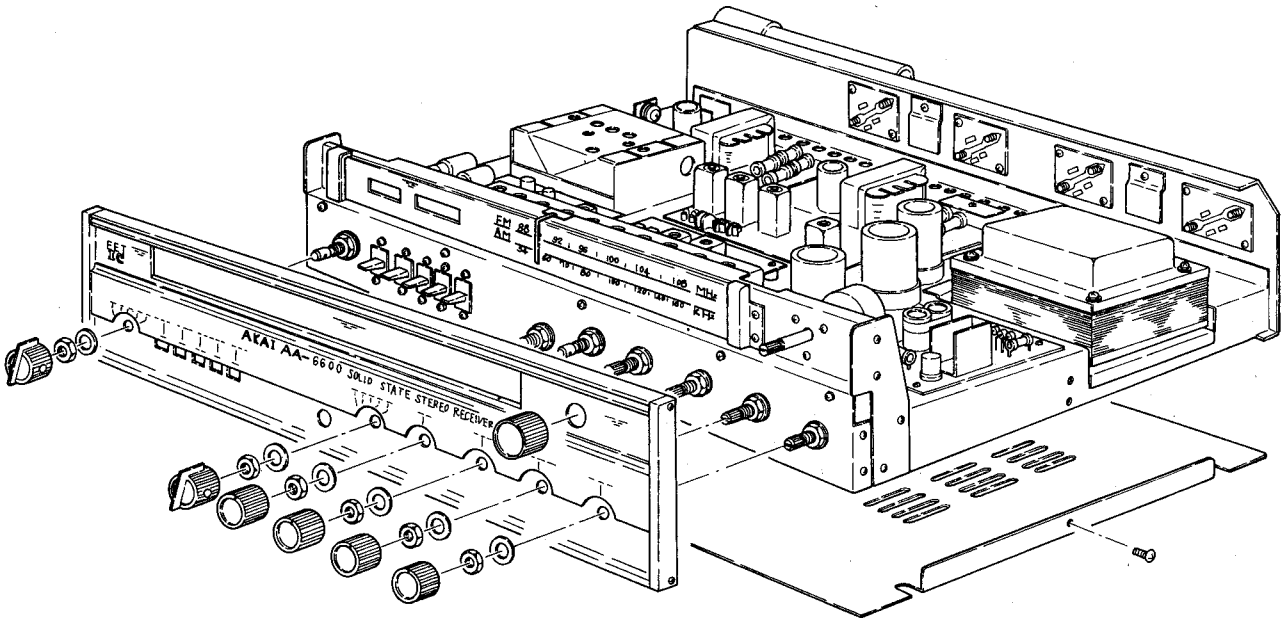
AM RECEPTION TROUBLE

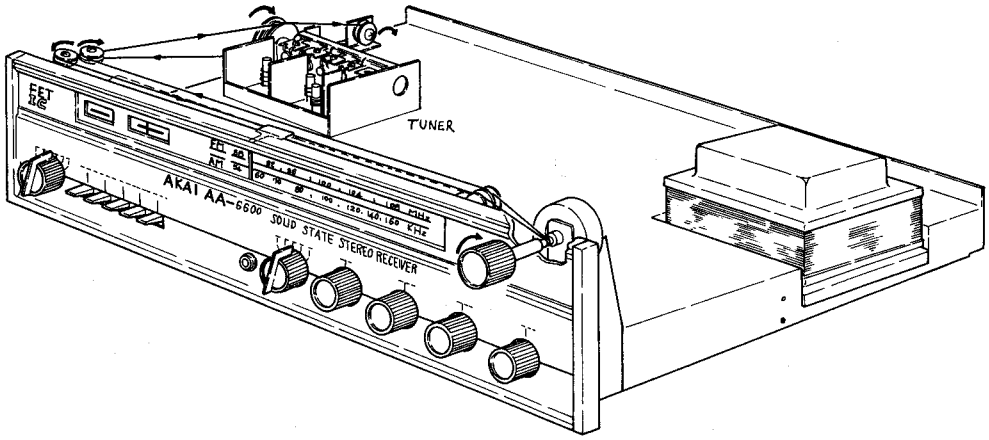
Symptom	Remarks	
No AM reception.	• Defective AM-IF circuit board (4004)	• Check voltage of TR-401 ~ TR-403. • Check SELECTOR switch.
Excessive noise.	• Weak signal.	• Use external antenna.
Hum when tuned to broadcasting station.	• Due to transmission lines or generating noise of electrical apparatuses (e.g. flouresent lamps, motors etc.) nearby.	• When bar antenna is used, reposition until noise is minimized. • Reset AC cord plyg.
Buzzing noise	• Due to a TV set nearby.	• Relocate amplifier.

WHEN EXTERNAL INPUT IS USED (Tape recorder Record player etc)

Symptom	Remarks	
No sound or increase of noise or Hum	• Faulty connection.	• Check connections and polarity referring to operators manual. • Check SELECTOR switch.

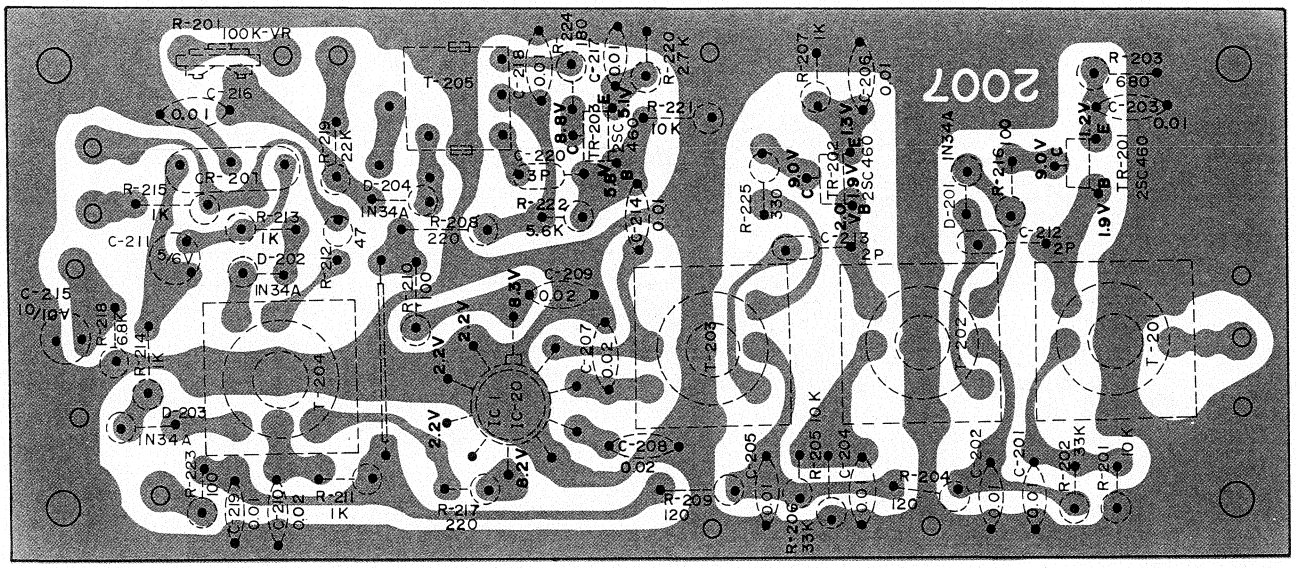
VI. REPLACEMENT OF DIAL CORD STRINGS



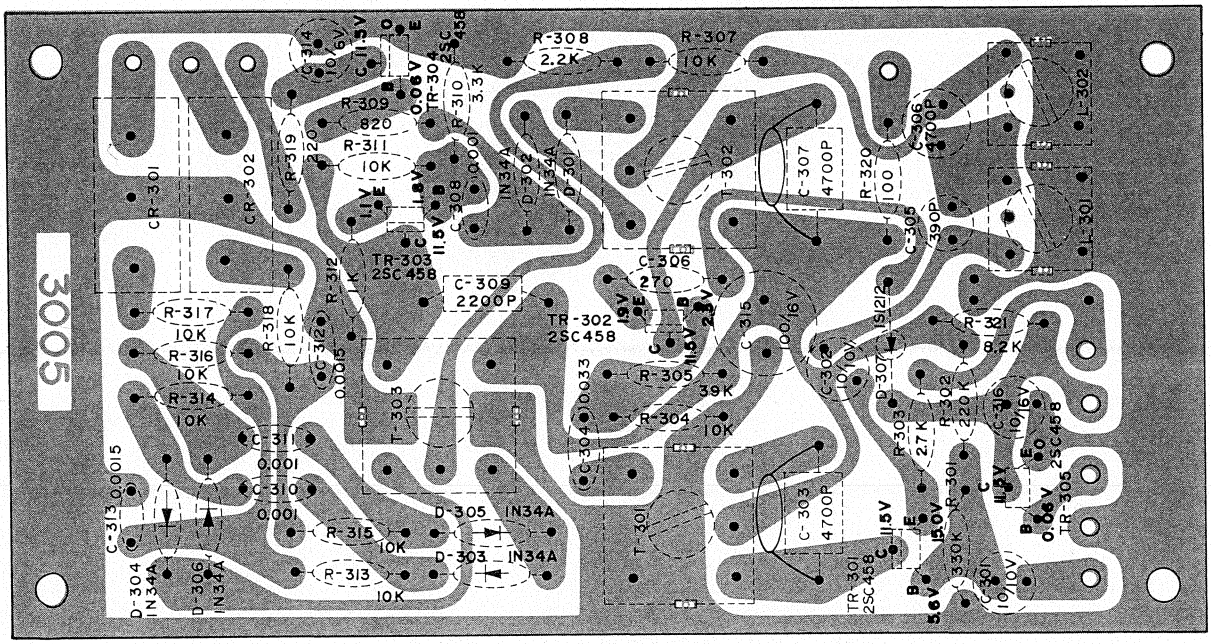


VII. COMPOSITE VIEWS OF COMPONENTS

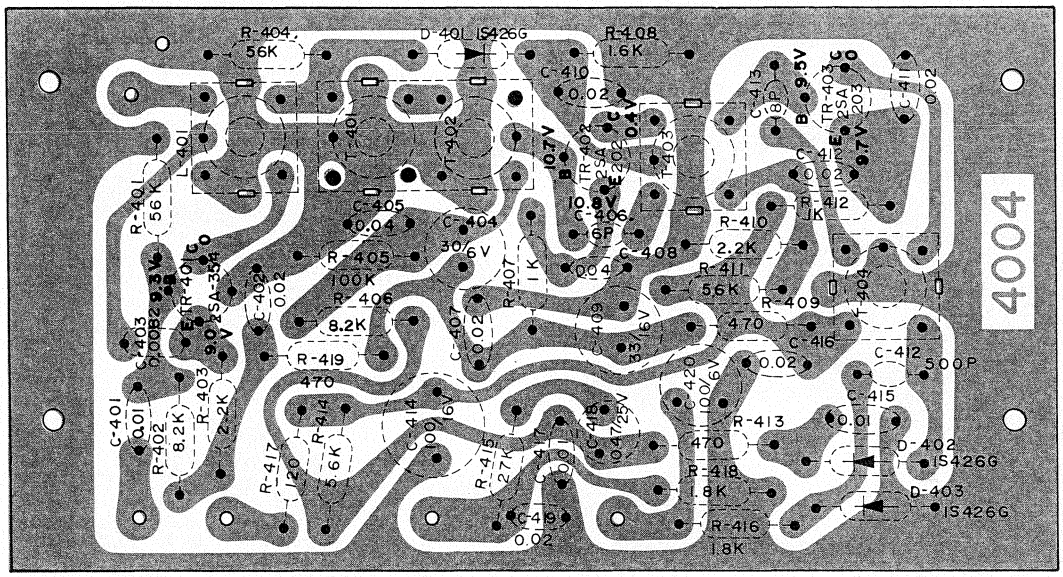
FM IF PRINTED CARD (2007)



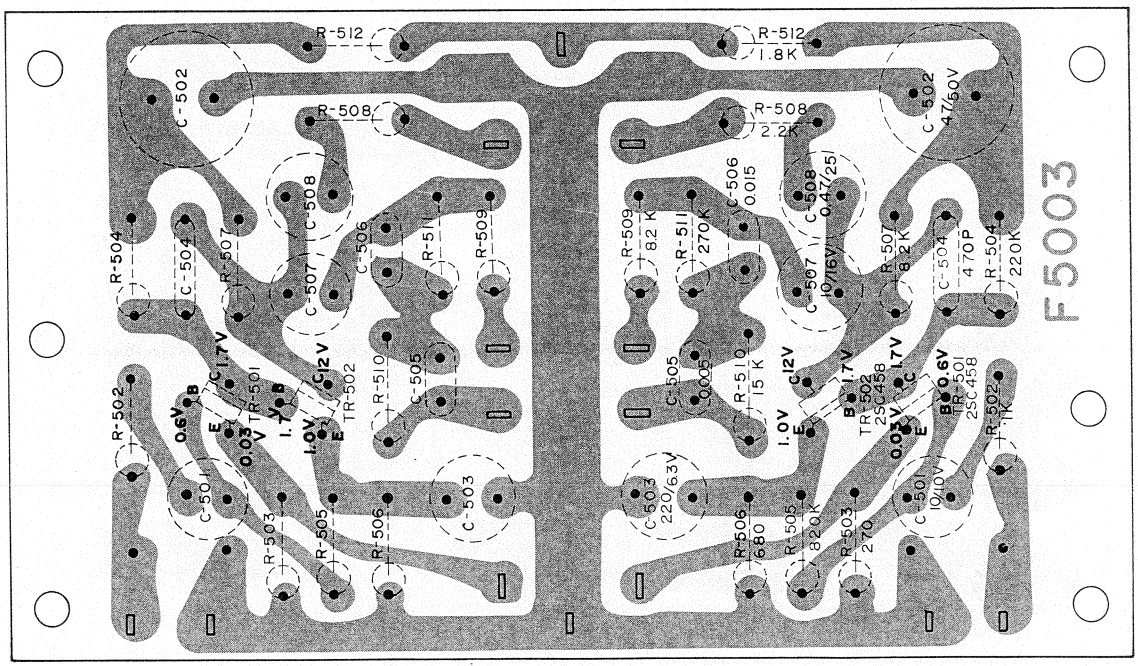
FM MPX PRINTED CARD (3005)



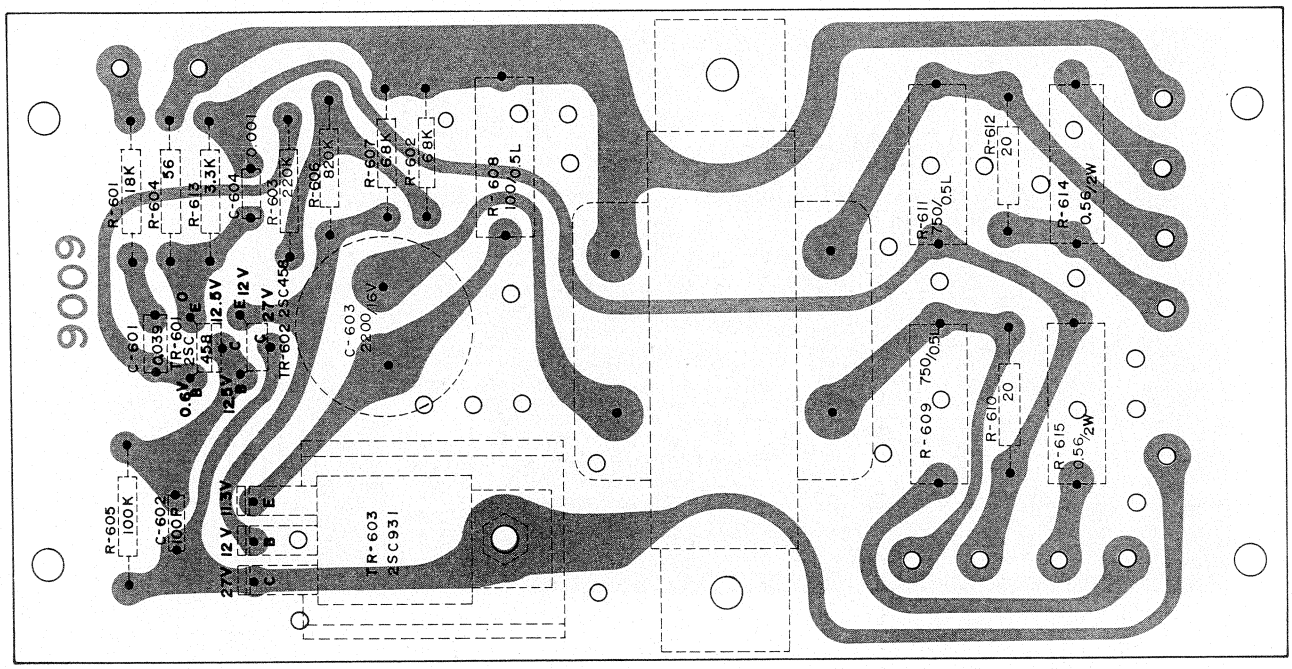
AM IF PRINTED CARD (4004)



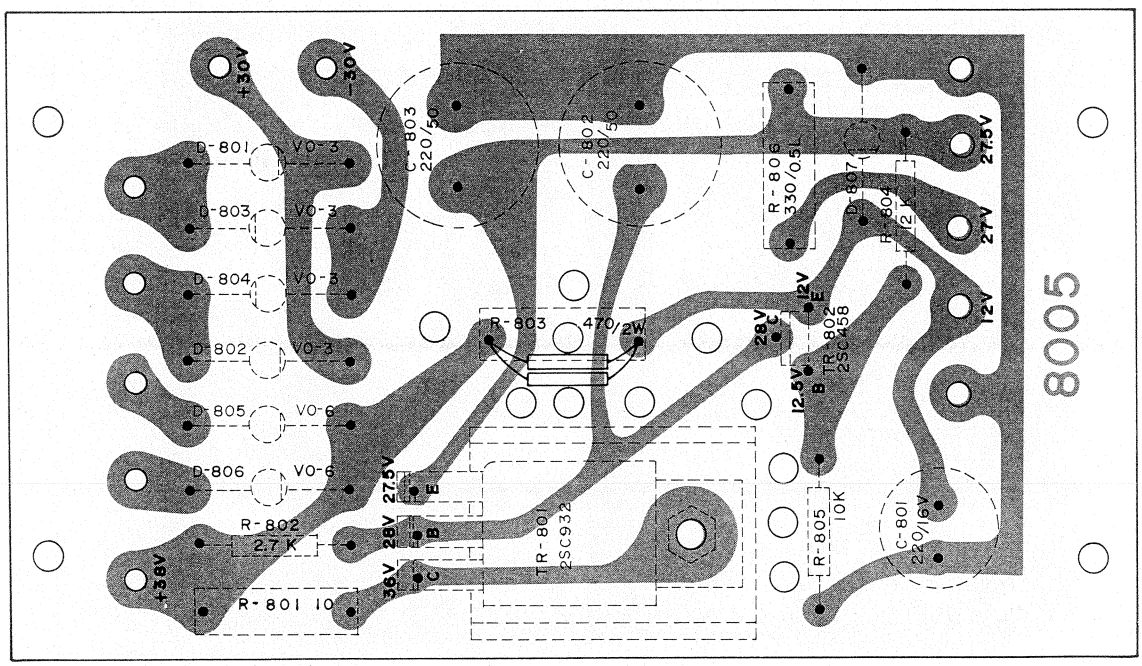
EQ. AMP. PRINTED CARD (5003)



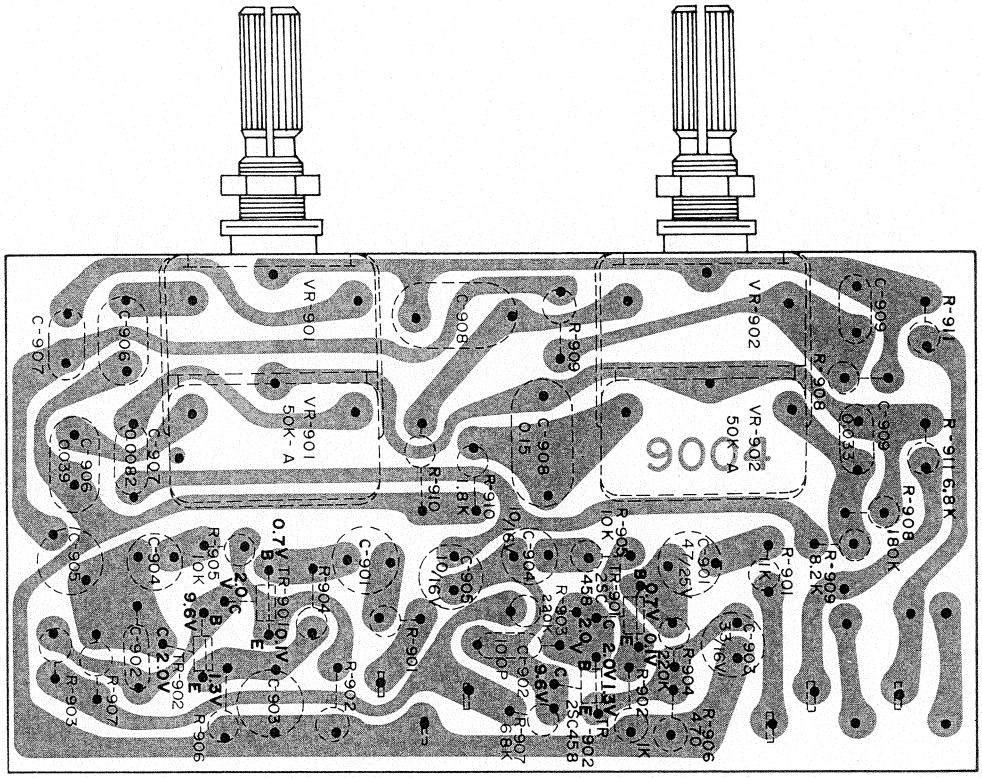
MAIN AMP. PRINTED CARD (6006)



POWER SUPPLY PRINTED CARD (8005)

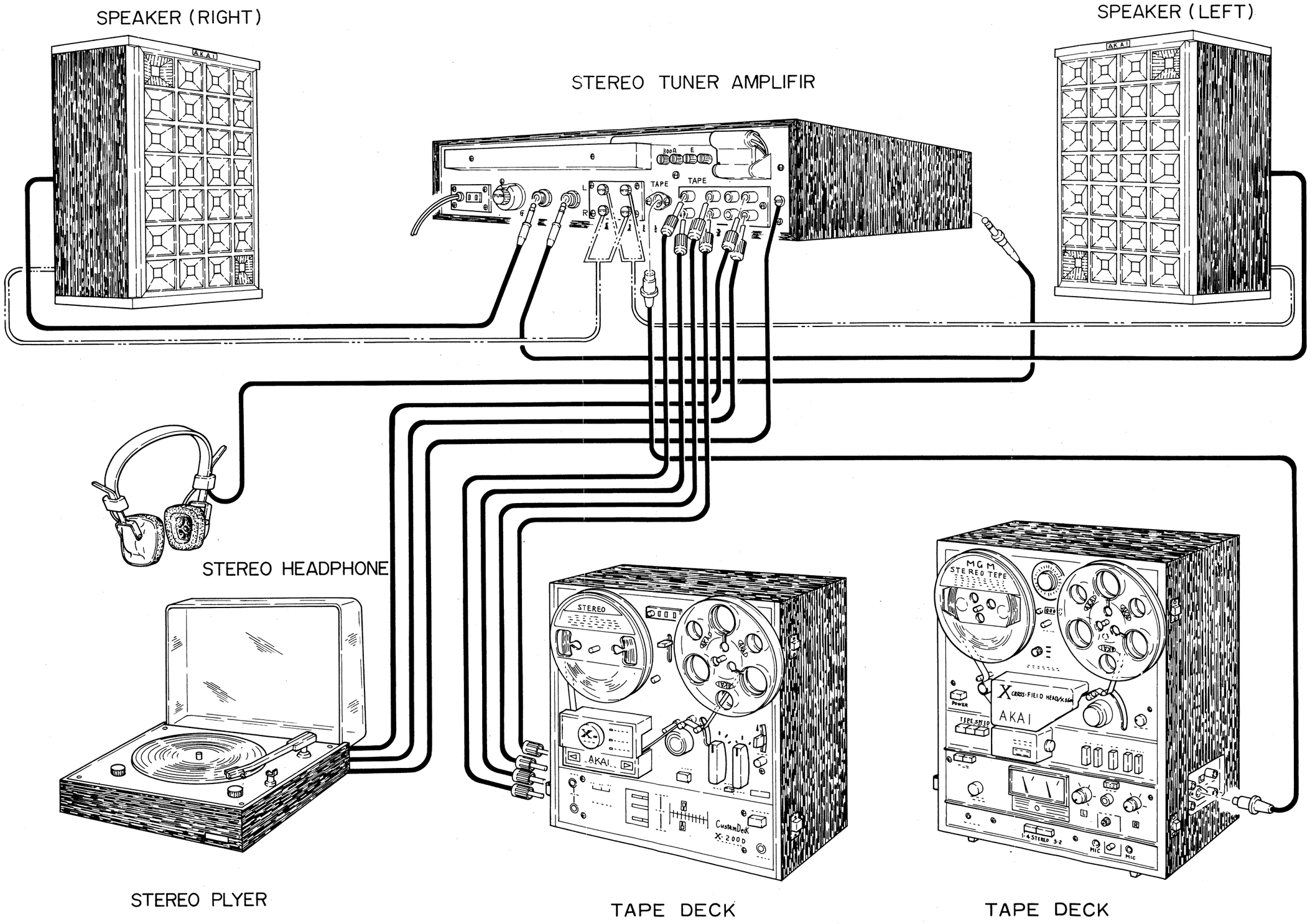


TONE AMP. PRINTED CARD (9004)



MENOS

VIII. CONNECTION DIAGRAM



FTA-60

※ VALUE OF COMPONENT MAY BE SELECTED DEPENDING ON EACH RECEIVER

△ 0.001~0.01

2007 FM IF BOARD

4004 AM IF BOARD

3005 FM MPX BOARD

IC CIRCUIT
HA-1101 or TA-7027

8005 POWER SUPPLY BOARD

9004 TONE AMP. BOARD

6006 MAIN AMP. BOARD

5003 EQ AMP. BOARD

AA-6600 CIRCUIT DIAGRAM 13820161